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A METHOD FOR PRODUCING AN ALUMINIUM COMPOSITE MATERIAL

The invention relates to a method for producing an aluminium composite material in which a cladding sheet is placed onto at least one side of a core ingot, and in which the core ingot with cladding sheets in place, is subjected to several roll passes. Furthermore, the invention relates to a method for producing cladding sheets from an ingot.

The production of aluminium composite materials comprising at least two different aluminium materials (i.e. two different aluminium alloys) is particularly advantageous for various applications or it makes it possible to use aluminium materials for particular applications. In this context, cladding by rolling represents a method for producing aluminium composite materials which makes it possible in a simple way to produce large quantities of aluminium composite strip or foil.

The actual cladding by rolling takes place in several steps, wherein the deformability during rolling depends on the particular material. If the limit of deformability is reached, the rolling process has to be interrupted and renewed heating, to the rolling temperature (above the recrystallisation threshold), has to be carried out. The ingot thickness as a starting format for hot rolling is selected such that even when thick sheets are rolled, the

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best possible kneading of the cast structure is achieved. The higher the material is alloyed and the lower the temperature during the last pass of the rolling material being rolled, the higher the hardening remaining in the material. In the case of plates or sheets intended for cladding by rolling, this may under certain circumstances lead to difficulties if these products do not achieve the specified strength values in the hot-rolling state on the available roll stands. Cladding by rolling takes place approximately at temperatures of 250 °C to 400 °C without intermediate annealing, with a lubricant comprising rolling oil, rolling emulsion or a mixture of rolling oil and rolling emulsion.

By producing aluminium composite materials, the properties of different aluminium materials can be combined in an optimal way. Thus for example, cladding of high-strength aluminium alloys with particularly corrosion-resistant aluminium alloys results in an aluminium composite material in which the core material provides the required strength values while at the same time the cladding material provides a surface with very good corrosion resistance which the core material could not provide because it is optimised with regard to the required strength. Furthermore, cladding makes it possible to produce an aluminium composite material with a melting point of its core material of for example 650 °C while the melting point of the cladding material is for example 620 °C. Components from such aluminium composite materials can now be interconnected in that the components are heated in a specific way to approx. 630 °C. As a result, the cladding layer melts on and ensures an coherent connection with the adjoining component.

From the state of the art it is know to produce cladding sheets or plates (for the sake of simplicity, hereinafter mostly called "sheets") for use in a generic method for producing an aluminium composite material in that a rolling ingot made of the cladding material is rolled down to the desired thickness on a hot roll. From the strip obtained in this way, plates for placement onto the core ingot are then cut off and placed onto the core ingot. Then this composite is subjected to cladding by rolling.

In this conventional method for producing an aluminium material there is a problem in that the production of cladding sheets on the hot roll is very time consuming. Such time extensive use of the hot roll for the production of cladding sheets is problematic from the point of view of optimised work processes in the rolling mill. At the same time, due to the principle of process, the parallel arrangement of cladding sheets made by rolling is poor. This results in uneven cladding which means that thicker plating sheets must be used than would be adequate with optimal plane-parallel arrangement, so as to ensure the necessary safety reserves. Furthermore, again due to inherent factors, only cladding sheets of the same thickness can be produced during the rolling process. This not only leads to increased storage expenditure for cladding sheets which are not yet used, but it also leads to increased production costs because the production of cladding sheets of different thickness means that several ingots made from the cladding material have to be subjected to a rolling process. At last, the surfaces of the cladding sheets produced by rolling must

be subjected to an expensive mechanical and chemical pre-treatment prior to rolling, so as to ensure impeccable connectability between the core ingot and the cladding sheets as a result of cladding by rolling.

It is the object of the present invention to provide a method for producing an aluminium composite material or a method for producing cladding sheets from an ingot which significantly simplifies the known processes and in addition makes it possible to use cladding sheets with improved properties.

According to a first teaching of the invention relating to a method for producing an aluminium composite material, the object explained and shown above is met in that the cladding sheets are cut off an ingot. By no longer obtaining the cladding sheets by rolling them from an ingot made of cladding material, as has been the case up to now with the state of the art, but instead, by directly cutting said cladding sheets from the ingot, there are a number of advantages when producing aluminium composite materials. First of all it is now also possible to produce cladding sheets of different thickness from one ingot; this will considerably simplify production and storage. Furthermore, with the process according to the invention, the precise number of cladding sheets required can be produced from the initial ingot without any special expenditure. The time expensive hot rolling of the ingot from the cladding material is dropped out. In addition, any re-stretching of the rolled plate, which has regularly been necessary in the case of cladding sheets made by rolling, is not apply in the case of cladding sheets which are directly cut off an ingot.

By cutting the cladding sheets from the ingot by sawing, according to an embodiment of the first teaching of the invention, an excellent plane-parallel arrangement of the cladding sheets can be achieved. Such exact plane-parallel configuration brings about an optimisation potential concerning the necessary thickness of the cladding sheets. Furthermore, the process of welding between cladding sheets and core ingots is considerably simplified. Finally this results also in reduced requirements concerning surface treatment of the cladding sheets cut off the ingot by sawing. In particular band saws are suitable for cutting cladding sheets from the ingot by sawing. In respect of ensuring plane-parallel configuration and minimum material removal, band saws are very well suited for use in the method according to the first teaching of the invention.

According to a further embodiment of the first teaching of the invention, the cladding sheets are cut off the ingot at a thickness of 2 to 100 mm. As has already been mentioned, these thicknesses can be adjusted without further ado from one cladding sheet to the other, thus providing the option of producing cladding sheets made from a single ingot for a wide range of cladding thicknesses.

Surface treatment of the core ingot and/or of the cladding sheets prior to rolling results in an optimal connection between the core material and the cladding material during the rolling process. As has already been mentioned, when compared to the requirements of cladding sheets produced by rolling, there are now significantly

reduced requirements concerning surface treatment of the cladding sheets which have for example been obtained by being cut off the ingot by sawing. This applies particularly with regard to chemical surface treatment.

According to a second teaching of the invention, the above-mentioned object for a method for producing cladding sheets from an ingot is met in that the cladding sheets are cut off an ingot. Of course, the advantages according to the invention also apply to the method, irrespective of the actual production method for an aluminium material, according to the second teaching of the invention, for producing cladding sheets from an ingot consisting of cladding material. The advantages of arranging a method for producing an aluminium material according to the first teaching of the invention can thus be transferred without further ado to a method for producing cladding sheets from an ingot according to the second teaching of the invention.

There are a multitude of options for arranging and improving the teachings according to the invention. To this effect we refer for example on the one hand to the claims which are subordinate to claim 1, otherwise also to the description of a preferred embodiment in conjunction with the drawing. The following are shown in the drawing:

Fig. 1 an embodiment of a core ingot comprising two cladding sheets, for use in a method for producing an aluminium composite material; and

Fig. 2 an embodiment of an ingot from which a cladding sheet is being cut off.

In the embodiment shown in Fig. 1, a core ingot 1 comprises a cladding sheet 2, 3 both at the top and at the bottom. The materials of the cladding sheets 2, 3 are for example corrosion-resistant aluminium materials, while the material of the core ingot 1 features high-strength.

Fig. 2 shows the production of a cladding sheet 4 made from an ingot 5 comprising the cladding material, by means of a band saw 6. For example, a band saw is arranged in front of a roll stand, said band saw cutting the rolling ingot in longitudinal direction into several cladding sheets, with the cut off cladding sheets being transported on a roller table connected directly to the core ingot. Fig. 2 shows that the method according to the invention makes it possible without further ado to cut cladding sheets 4 of different thickness and of exact plane-parallel configuration into the required number of plates.